AIRFLOW DISTRIBUTION AT DIFFERENT FLOOR LEVEL AT SMK BUKIT KATIL ACT AS A TEMPORARY EVACUATION CENTRE

MOHAMAD ASYRAF AIDEE BIN MOHD BASERI
B091810017

BACHELOR OF MECHANICAL ENGINEERING TECHNOLOGY (REFRIGERATION AND AIR CONDITIONING SYSTEM) WITH HONOURS

2022

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Faculty of Mechanical and Manufacturing Engineering Technology

AIRFLOW DISTRIBUTION AT DIFFERENT FLOOR LEVEL AT SMK BUKIT KATIL ACT AS A TEMPORARY EVACUATION CENTRE

Mohamad Asyraf Aidee Bin Mohd Baseri

Bachelor of Mechanical Engineering Technology (Refrigeration and Air Conditioning system) with Honours

2022

AIRFLOW DISTRIBUTION AT DIFFERENT FLOOR LEVEL AT SMK BUKIT KATIL ACT AS A TEMPORARY EVACUATION CENTRE

MOHAMAD ASYRAF AIDEE BIN MOHD BASERI

A thesis submitted
in fulfillment of the requirements for the degree of
Bachelor of Mechanical Engineering Technology (Refrigeration and Air Conditioning System) with Honours

Faculty of Mechanical and Manufacturing Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2022

DECLARATION

I declare that this Choose an item. Entitled " Airflow Distribution At Different Floor Levels At SMK Bukit Katil Act As Temporary Evacuation Centre" is the result of my own research except as cited in the references. The Choose an item. has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : 

Name : Mohamad Asyraf Aidee Bin Mohd Baseri

Date : 28/01/2022

APPROVAL

I hereby declare that I have checked this thesis, and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor of Mechanical Engineering Technology (Refrigeration and Air Conditioning System) with Honours.

Signature : 

Supervisor Name : Ts. Dr. Amir Abdullah Bin Muhamad Damanhuri

Date : 28/01/2022

DEDICATION

I would like to dedicate the success of this research to my parents, Mohd Baseri Bin Zakaria and Noor Wanee Binti Ab. Ghafar @ Mustapha. This report is dedicated to them because I want to express my gratitude for all their sacrifices for me throughout my time at this university. Second, this dedication is made to my siblings, who assisted me in completing this report through counsel, financial assistance, and encouragement. Following that, I'd like to offer my heartfelt appreciation to my supervisor, Ts. Dr. Amir Abdullah Bin Muhamad Damanhuri and my friends for their assistance in finishing this Final Year Project.

ABSTRACT

Natural disasters are often mentioned in Malaysia, and floods are one of the disasters that occur in our country every year. Due to this disaster, flood victims will be sent to evacuation centres to seek temporary shelter. Occupants in evacuation centres face various problems, including poor ventilation. Due to poor ventilation, the occupant quickly feels hot and uncomfortable while in the evacuation centre. A sampling of temperature and nature airflow velocity data is done at different floor levels every 30 minutes for 24 hours at SMK Bukit katil Melaka, Malaysia, used as a temporary evacuation centre. The data will be simulated in Ansys Workbench to get an airflow view consisting of two conditions: the classroom equipped with a tent and the classroom not fitted with a tent. The average air velocity and temperature result in the three floors is 0.47 m/s and 27.2 ° C for the ground floor, 0.64 m/s and 27.1 ° C for the first floor, and 1.33 m/s and 27.2 ° C for the second floor. And the simulation results from the Ansys Workbench software performed on all the floor levers showed the following readings: The average is 0.28 m/s (no tent) and 0.14 m/s (included tent) for the ground floor, 0.34 m/s (no tent) and 0.28 m/s (tent included) for the first floor, and 0.63 m/s (no tent) and 0.59 m /s (included tent) for the second floor. The study results found that the wind speed at each different floor level is different. And the results of the simulations on the three floors showed a slower wind speed after using the tent. This study can help the social welfare department provide a more comfortable evacuation centre. Level selection and installation of the tent at the correct floor level will help the victim achieve thermal comfort in natural ventilation.

ABSTRAK

Bencana alam sering menjadi sebutan di Malaysia, dan banjir merupakan salah satu bencana yang berlaku di negara ini setiap tahun. Disebabkan bencana ini, mangsa banjir akan dihantar ke pusat pemindahan untuk mendapatkan perlindungan sementara. Penghuni di pusat pemindahan menghadapi pelbagai masalah termasuk pengudaraan yang lemah. Penghuni pusat permindahan sementara cepat berasa panas dan tidak selesa semasa berada di sana. Persampelan data halaju angin semula jadi dan suhu pusat permindahan banjir dilakukan di 3 aras yang berbeza selama 24 jam dan selang waktunya adalah 30 minit di SMK Bukit katil, Melaka yang beroperasi sebagai pusat pemindahan sementara. Data tersebut akan disimulasikan dalam Ansys Workbench untuk mendapatkan pergerakan aliran udara yang terdiri daripada dua keadaan: Bilik darjah yang dilengkapi dengan khemah dan bilik darjah tidak dilengkapi dengan khemah. Hasil purata halaju angin dan suhu di tiga tingkat yang berbeza ialah: 0.47 m/s dan 27.2 ° C untuk tingkat bawah, 0.64 m/s dan 27.1 ° C untuk tingkat satu, 1.33 m/s dan 27.2 ° C untuk tingkat dua. Dan hasil simulasi daripada perisian Ansys Workbench yang dilakukan pada semua tingkat yang berbeza menunjukkan bacaan seperti berikut: Purata halaju angin adalah 0.28 m/s (tiada khemah) dan 0.14 m/s (termasuk khemah) untuk tingkat bawah, 0.34 m/s (tiada khemah) dan 0.28 m/s (termasuk khemah) untuk tingkat satu, dan 0.63 m/s (tiada khemah) dan 0.59 m/s (termasuk khemah) untuk tingkat dua. Hasil kajian mendapati kelajuan angin pada setiap aras adalah berbeza. Dan hasil simulasi yang dilakukan di tiga tingkat tersebut menunjukkan kelajuan angin lebih perlahan selepas menggunakan khemah. Kajian ini sedikit sebanyak dapat membantu pihak jabatan kebajikan masyarakat (JKM) menyediakan pusat pemindahan yang lebih selesa. Pemilihan aras dan pemasangan khemah pada aras yang betul akan membantu mangsa mencapai keselesaan terma dari segi pengudaraan semula jadi.

ACKNOWLEDGEMENTS

In the Name of Allah, the Most Gracious, the Most Merciful

First and foremost, I would like to express my heartfelt gratitude to Allah the Almighty for his assistance and guidance during my life and at the moment of fact. I successfully finished my final year project study at University Technology Malaysia's Faculty of Mechanical and Manufacturing Engineering Technology (UTeM). At this time, I would like to express my appreciation to all parties involved, especially Ts. Dr. Amir Abdullah Bin Muhamad Damanhuri, the supervisor of the final year project, for providing me with the opportunity to complete the final year report project.

There are many lessons I can learn when doing this final year study. Finally, I'd like to thank my parents for their encouragement and belief in my ability to complete my Final Year Project Thesis. I'd like to thank everybody once again. Both of their kindness and generosity to me will be honoured till the end of time. Thank you so much.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS AND ABBREVIATIONS

D,d	-	Diameter
CFD	-	Computational Fluid Dynamics
PM	-	Particulate matter
SO_2	-	Sulfur dioxide
NOx	-	Nitrogen oxide
VOCs	-	Volatile organic compounds
VVOCs	-	Very volatile organic compounds
ASHRAE	-	American Society of Heating, Refrigerating and Air-Conditioning Engineers
HVAC	-	Heating, ventilation, and air conditioning
CO_2	-	Carbon dioxide
IAQ	-	Indoor air quality
DOSH	-	Department of Occupational Safety and Health
W1	-	Window 1
W2	-	Window 2
W3	-	Window 3
W4	-	Window 4
D1	-	Door 1
D2	-	Door 2
SMK	-	Sekolah Menengah Kebangsaan

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background

At the end of 2014, peninsular Malaysia was devastated by one of the biggest flood catastrophes in the country's history, affecting Kelantan, Terengganu, Pahang, and Johor. According to the National Calamity Management Agency or NADMA, the flood occurrence in Kelantan in December 2014, described as a "tsunami-like disaster", was the most demanding and significant flood among the impacted states (Su-Lyn, 2015). Two hundred two thousand flood victims were relocated to various evacuation centres across ten districts (PAM, 2015).

The flood has caused infrastructure damage estimated at RM 2.9 billion. As part of the 2015 budget revision, the government committed about RM 8.9 billion for flood recovery operations on the east coast, including rehabilitation operations and welfare programs for flood victims and repairs and restoration of fundamental infrastructure (Akasah & Doraisamy, 2015). As a result, floods have posed several physical, environmental, and economic issues to society, the government, and the built environment.

Choosing public locations to serve as evacuation centres is critical during the disaster preparations and response stages (Bashawri et al., 2014). Public schools and community halls that serve as temporary shelters are naturally existing facilities created for their purposes but are forced to serve as shelters during a disaster's emergency phase. Malaysia National Directive No. 20. The administration expresses its desire to offer flood

victims a safe and healthy living environment at the evacuation centres. While most evacuation centres now meet the demands of victims, a large number of them require space adjustments and structural renovations to endure future calamities (PAM, 2015).

At the evacuation centres, before the flood disaster in Kelantan 2014, the evacuation centre was inhabited by residents without using tents in the evacuation centres. All families are gathered in one place used as an evacuation, such as a classroom or hall. After the major floods in Kelantan, the government realized the importance of using tents in the evacuation area to protect the privacy of each family (Jabatan Kebajikan Masyarakat). Here arises the problem related to thermal comfort. One of the problems is poor airflow, causing people in the tent to feel hot and uncomfortable. This is because poor ventilation and stuff inside the evacuation centre are not correct, causing this problem (Jamaludin et al., 2015). This thesis aims to study using the actual area of the evacuation centres to be simulated in Ansys Workbench software. In this study, Ansys Workbench software solved problems related to ventilation. This study can help parties related to flood management, such as NADMA, the Department of Community Welfare (JKM).

1.2 Problem Statement

If the evacuation centre becomes overcrowded, the heat generated within the facility will become an issue. Several sources cause occupants in buildings to feel hot. Among the source is human body temperature. The body's temperature is maintained at 37 °C. The room's temperature might be raised a few degrees by combining body temperatures (Britannica, 2017).

Inadequate ventilation also contributes to heat in a place. By Tancrède 1987, residents of the evacuation facility would suffer due to the lack of moving air (Tancrède et al., 1987). Uncomfortable conditions and excessive heat in the facility were the most often reported issues, accounting for 48.3 % of all complaints. The incidence of conflicts at evacuation centres is also due to this factor (Said et al., 2013).

Because the hot outside air causes the inside of the structure to grow heated, the building's inhabitants are constantly confronted with increasing heat within the building (Shittu, 2015). All these problems will cause people around to be uncomfortable, and this study covers natural airflow that can address all of the issues above.

1.3 Research Objective

This research aims to improve airflow at an evacuation centre in a tropical climate region. Specifically, the objectives are as follows:

i. To monitor three different floors at SMK Bukit Katil, Melaka, Malaysia, act as a temporary evacuation centre.

ii. To simulate airflow distribution in 3 different floors in the evacuation centre at SMK Bukit Katil, Melaka, Malaysia, act as a temporary evacuation centre.

1.4 Scope of Research

The scope of this research are as follows:

i. Software SolidWorks 2016 to create a 3d building simulation drawing.

ii. Software Ansys Workbench student 2021 R2 created airflow simulations in the evacuation centre.

iii. This study is focused on the SMK Bukit Katil, which act as an evacuation centre in Melaka, Malaysia.

iv. The study was only on the ground floor, first floor, and second floor of the school building

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

There are study workings in the section that should be handled with this section. Literature reviews were required to collect the knowledge or data needed to validate this study of the airflow distribution in evacuation centres. First is research about floods in Malaysia and focus more detail on Melaka. Also stated in this chapter are evacuation centres, thermal comfort, poor distribution, indoor air quality, natural ventilation in the building, distribution parameters, and the last is research about previous Simulations using CFD software.

2.2 Floods in Malaysia

Any high water flow that dominates the natural or manmade banks in any area of the river system is referred to as a flood. As a result, when a riverbank is overtopped, the water extends over the flood plain, posing a threat to society (OSMAN, 2017). Floods have devastating consequences for people because they disturb their daily routines, and the effects might last up to a week. Climate change is projected to make the situation much more difficult (Chan et al., 2015).

Flooding is a natural occurrence that can't be avoided or minimized no matter how much a government or community tries (Hamzah et al., 2012). Flood is the most destructive natural calamity Malaysia has ever seen. There are 189 river basins in

Malaysia, including Sabah and Sarawak, with primary flows running straight to the South China Sea, and 85 of them are prone to frequent floods (89 of the river basins are in Peninsula Malaysia, 78 in Sabah, and 22 in Sarawak). The projected area vulnerable to flood catastrophe is around 29,800 km^2 or 9% of Malaysia's total territory, and it affects almost 4.82 million people, or about 22% of the country's entire population (N.W Chang, 2000).

The Malaysian Drainage and Irrigation Department categorizes floods in Malaysia into two types, flash floods and monsoon floods (D/iya et al., 2014). The time it takes for the river flow to return to normal levels is the evident difference between these two disasters from a hydrological standpoint. Monsoon floods can linger for a month, whereas flash floods take only a few hours to restore normal water levels (Noorazuan, 2006). The rainfall pattern in Malaysia is seen in Figure 2.1 and how it is impacted by the two monsoons, the southwest and northeast monsoons. Malaysia is split into two parts, West Malaysia (Peninsula Malaysia) and East Malaysia (Sabah and Sarawak), which the South China Sea separates (D/iya et al., 2014). Figure 2.1 shows Southwest and Northeast monsoons.

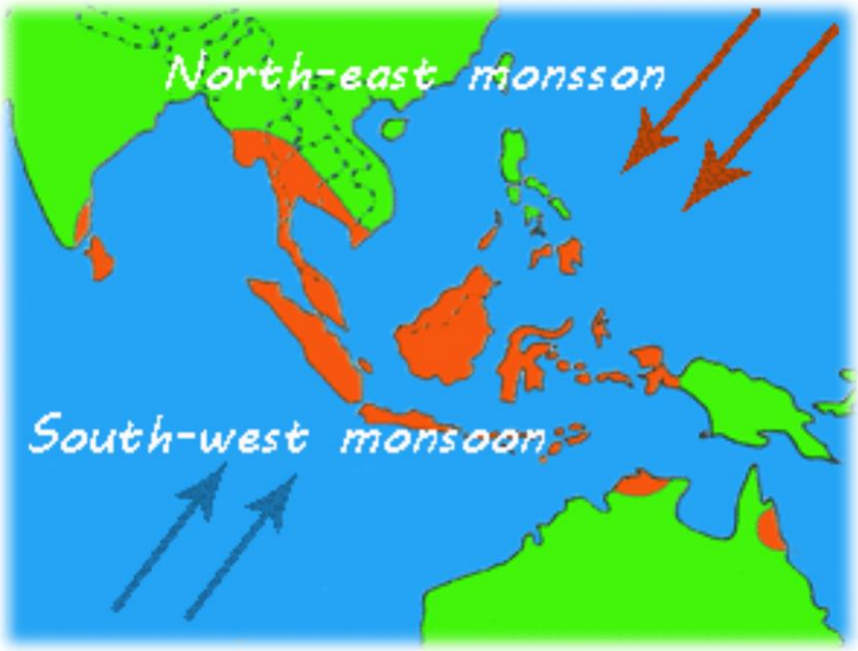

Figure 2.1Direction shows the Southwest and Northeast monsoons. Source:(D/iya et al., 2014)

Local weather fluctuations are one of the natural causes of flash floods however, non-natural reasons such as an ineffective urban drainage system and an increase in the number of buildings in urban areas are the leading causes of flash floods in the Klang Valley Peninsular (Akasah & Doraisamy, 2015). According to Chan (2000), the danger and vulnerability of urban people to floods have lately grown due to an increase in impervious surfaces such as roads, buildings, and parking spaces. In addition, floods have been seen to have a more significant economic impact on low-income residents, particularly those living in flood-prone areas (Chan, 2000). With their meagre income, they can only make a little effort to alleviate the effects of floods (Hamzah et al., 2012). Since the 1920s, Malaysia has been hit by a succession of floods, the most recent of which occurred in December 2006 and January 2007. As a result of these floods, the rescue and recovery agencies have gained valuable expertise.